Prevalence and Level of *Campylobacter* in Commercial Broiler Breeders (Parents) and Broilers

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SUMMARY

***Campylobacter* is the leading cause of bacteria-induced diarrheal disease, and the major vehicle for transmitting this microorganism to humans is poultry. Recent research has shown that *Campylobacter* can pass from the breeder hen to her progeny through the fertile egg, which is now considered to be a significant source of entry into the broiler flocks. Because of the importance of the organism in parent flocks, this work was carried out to determine the prevalence and level of *Campylobacter* in the parents (breeders) and offspring (broilers) of commercially reared birds.**

Key words: Breeder, broiler breeder, *Campylobacter*, feces, flock

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DESCRIPTION OF PROBLEM

The United States poultry industry processes more than eight billion broiler hatching eggs through commercial incubating facilities each year. Bacteria can rapidly penetrate the shell and membranes of freshly laid fertile hatching eggs. The conditions that exist during the incubation of a hatching egg tend to favor the proliferation of most microorganisms [1]. *Campylobacter* enteritis is the leading cause of bacterial induced diarrheal disease in the United States and worldwide, and the major vehicle transmitting *Campylobacter* to humans is poultry [2]. Research efforts to diminish the presence of this organism on processed poultry have had limited success primarily because there is a paucity of conclusive information concerning how *Campylobacter* gets into commercial poultry flocks. Recent findings by Cox and others [3] have conclusively demonstrated that *Campylobacter* can pass from the breeder hen to her progeny through the fertile egg. Because this transfer is now considered to be a significant source of entry of *Campylobacter* into commercial poultry flocks, the objective of this study was to determine the prevalence and level of this organism in commercial breeders and broilers.

MATERIALS AND METHODS

In the first part of this study, 35 commercial broiler flocks (~20,000 birds/flock) from Alabama, Arkansas, California, and Georgia were analyzed for *Campylobacter* colonization by culturing their fecal droppings. Fourteen broiler breeder flocks from Georgia and Alabama were also analyzed. Twenty-five fecal droppings were collected from each flock. Fresh droppings were chosen at random from the floor of the entire length of the house that housed each flock. The droppings were aseptically placed into sterile disposable centrifuge tubes, packed in ice, and transported to the laboratory. Slurries were prepared from each sample by adding 3 mL of buffered peptone [4] for every gram of feces

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TABLE 1. Prevalence of *Campylobacter* in the fecal droppings of 35 commercial broiler flocks (from 4 to 8 wk of age)

Flock number	*Campylobacter*-positive droppings out of 25		Flock number	*Campylobacter*-positive droppings out of 25	
	n	%		n	%
1	4	16	18	5	20
2	10	40	19	24	96
3	0	0	20	22	88
4	25	100	21	25	100
5	15	60	22	17	68
6	25	100	23	25	100
7	25	100	24	0	0
8	25	100	25	25	100
9	16	64	26	0	0
10	24	96	27	2	8
11	25	100	28	17	68
12	10	40	29	22	88
13	25	100	30	10	40
14	23	92	31	14	52
15	6	24	32	7	28
16	25	100	33	7	28
17	24	96	34	10	40
			35	3	12

and then vortex mixing. Serial dilutions were prepared and plated onto Campy-cefex agar plates [5] by using a sterile plastic inoculating loop. The plates were then incubated in a controlled atmosphere of 5% O_2, 10% CO_2, and 85% N_2 for 24 to 36 h at 42°C. Characteristic colonies were confirmed as *Campylobacter* spp. by observation of cellular morphology and motility on a wet mount using phase contrast microscopy. Further confirmation was collected on a representative number of samples by using the serological latex agglutination test to identify isolates as *C. jejuni*, *C. coli*, or *C. lari* [6].

In the second part of the study, a broiler breeder flock was analyzed twice for *Campylobacter* colonization. Subsequently, three broiler flocks that were the progeny of this flock were also analyzed during the last week of growout (6 wk). For this part of the experiment, 50 fecal samples were collected each time a flock (breeder or broiler) was tested for *Campylobacter* colonization. Methods used were identical to those described above.

RESULTS AND DISCUSSION

The prevalence of *Campylobacter* in commercial broiler houses and commercial broiler breeder (parent) houses is shown in Tables 1 and 2. Of the 35 broiler flocks (Table 1), three were *Campylobacter* negative, and prevalence ranged from 8 to 100% positive. From these 35 commercial flocks, 875 fecal droppings were analyzed for *Campylobacter* and 542 (62%) of them were found to have viable *Campylobacter* present. In a 1995 study to compare non-destructive techniques to determine whether flocks were positive for *Campylobacter*, Stern and Robach [7] found 58% of broiler cecal droppings, 45% of fecal droppings, and 41% of cloacal swabs to be positive. Although cecal droppings were more sensitive samples than fecal droppings or cloacal swabs for detecting *Campylobacter*, they were also the most difficult to collect. For this reason, fecal samples were used to determine flock colonization status in this study. Kazwala and others [8] found 35% (90/255) of broiler fecal samples to be positive from 17/21 farms, whereas Jacobs-Reitsma and others [9] found houses on two Dutch farms to be 100% colonized.

All of the 14 commercial breeder flocks tested in this study were contaminated with *Campylobacter* (Table 2). The prevalence of these flocks ranged from 12 to 80%. From these 14 commercial parent flocks, 350 cecal droppings were analyzed for *Campylobacter* and 200

TABLE 2. Prevalence of *Campylobacter* in the fecal droppings of 14 commercial broiler breeder (parent) flocks from 46 to 62 wk of age

	Campylobacter-positive droppings out of 25	
Flock number	n	%
1	16	64
2	17	68
3	17	68
4	16	64
5	14	52
6	10	40
7	3	12
8	10	40
9	13	52
10	16	64
11	17	68
12	19	76
13	20	80
14	12	48
Overall	200/350	57.1

(57.1%) of them had viable *Campylobacter* present. These findings are similar to those of Jacobs-Reitsma [10]. She found that 29 of 43 (67%) breeder flocks in the Netherlands were contaminated with *Campylobacter*. The high level of *Campylobacter* contamination in these commercial breeder flocks should cause a great deal of poultry industry concern because a recent study has demonstrated the passage of *Campylobacter* from breeder to progeny through the fertile egg [3]. Also, it is interesting to note, that although biosecurity efforts are much more aggressive with breeders than broilers, 100% of the breeder flocks were contaminated with *Campylobacter*, whereas 91.4% of the broiler flocks were colonized.

Although the first part of study examined breeder and broiler flocks that were not related to one another, in the second part of this study prevalence and level of *Campylobacter* in the fecal droppings of a broiler breeder (parent) flock was compared to data collected from broiler flocks, which were their progeny, at Week 6 of growout (Table 3). Ninety percent of the breeder birds were shedding *Campylobacter* with an average level of 3.35 log cfu/g of cecal droppings. The three separate broiler flocks that were offspring of the above mentioned breeder flock had *Campylobacter* shedding rates of 100, 42, and 82%, respectively. The average levels of *Campylobacter* of the three broiler flocks, respectively, were 6.5, 5.4, and 3.5 log cfu/g of fecal droppings, respectively.

Although only 74.7% (112/150) of offspring were shedding *Campylobacter* as compared to 90% of the parents, the broilers were more heavily colonized (5.1 vs. 3.4 log cfu *Campylobacter*/g feces). Forty-seven percent (53/112) of the

TABLE 3. Incidence and level of *Campylobacter* in the fecal dropping of a broiler breeder (parent) flock and the subsequent offspring (three separate broiler flocks)

Type of flock	Samplings	Incidence[A]	Level[B]
Broiler breeder (parent)	1	50/50	3.9
	2	40/50	2.8
Broiler (offspring)	1	50/50	6.5
	2	21/50	5.4
	3	41/50	3.5

[A]Number of *Campylobacter*-positive samples of fecal droppings/the total number of samples tested.
[B]Value is expressed as average $\log_{10}$ cfu *Campylobacter*/g fecal dropping.

contaminated broiler droppings had greater than one million *Campylobacter*/g, whereas only 4.4% (4/90) of the parents had that high degree of contamination. Additionally, 24.4% of the breeder droppings had less than 1,000 *Campylobacter*/g, whereas only 4.5% of the contaminated broilers had levels that low.

Now that the transmission of *Campylobacter* from breeder to progeny through the egg has clearly been demonstrated [3], additional studies such as this one are needed to assess the extent of contamination in breeder birds. This published research is the first to study the prevalence and levels of *Campylobacter* in parent birds and their subsequent offspring. Studies are presently underway to fully understand the association of *Campylobacter* (and other foodborne enteropathogens) with the reproductive tract of the broiler breeder. This research will assist in the development of effective intervention strategies to reduce *Campylobacter* in poultry, which will then reduce human exposure to this important microorganism.

CONCLUSIONS AND APPLICATIONS

1. The prevalence of *Campylobacter* in breeders and broilers was similar and substantial.
2. The level of *Campylobacter* was approximately 2 log/g higher in broilers than in breeders.
3. These results provided further circumstantial evidence that breeder-to-broiler transmission of *Campylobacter* does indeed occur and dictates that intervention strategies should aggressively target critical control points previously excluded for *Campylobacter*, such as breeder flocks, hatching cabinets, and hatchery environments.

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